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# Did you really do this? E-authentication raising confidence in e-assessment

## Authors

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## Abstract

As many universities increase their online provision, there is a growing need for advances in at least one aspect of e-assessment: that of ensuring the individual doing the assessment is who the institution thinks they are, e-authentication. When online assessment is used solely for formative assessment, where assessment and feedback are focussed on learning rather than evaluating for the award of credit, this is not an issue. However, where online assessment is intended to contribute to a student's overall grading, institutions must be confident it is the student's work that is being marked. In the current environment this constraint places strong limits on the options for online assessment.

The EU-funded TeSLA project - Adaptive Trust-based e-Assessment System for Learning (<http://tesla-project.eu>) has developed a suite of instruments aimed at addressing this need. The suite is designed to integrate within a university's virtual learning environment and includes face recognition, voice recognition, keystroke dynamics, forensic analysis and plagiarism detection. These tools were trialed across the seven partner institutions and participating students (4,058, including 330 SEND) and teaching staff (54) completed questionnaires that revealed their views.

This paper describes the findings of this large-scale study where over 50% of students gave a positive response to the use of these tools. In addition, over 70% agreed that these tools were 'to ensure that my examination results are trusted' and 'to prove that my essay is my own original work'. Teaching staff also reported positive experiences of TeSLA: the figure reaching 100% in one institution. We show there is some evidence that student perceptions of trust can shift between their pre- and post-intervention questionnaires. Therefore, highlighting the risk that whilst students remain positively disposed to the institution there may be some diminution of trust associated with the introduction of new technologies into the student experience.

## Introduction

Many traditional face-to-face universities are beginning to provide online learning options for some of their teaching but the experience is that there are academic integrity issues that complicate putting assessment online. These issues are primarily to do with identity but also to do with cheating and are the same issues that have always existed, whether face-to-face or online. These combined issues of identity and cheating may be described as a problem of authentication.

Solutions to this authentication problem include putting in place high levels of security to ensure the right person sits an assessment and does not cheat in answering the questions. Conventionally, this is achieved through examinations where student identity is checked on entrance and invigilators, proctors, observe the process of assessment to be confident no cheating takes place. The high levels of resource required for this form of assessment make it suitable for infrequent, high stakes assessment. At the other end of the spectrum one could link a very small proportion of a course's overall marks to a very straightforward online activity. If there is no advantage in cheating, for instance if the student is simply required and the consequences of being discovered cheating are high enough, and low levels

for low stakes assessment. Some universities use 100% online proctoring for their assessment e.g. Western Governors University, WGU, in the USA. The cost of this means they will set few assessment points with a high proportion of course marks associated with it. Need to ensure there is sufficient disincentive to cheat to put people off.

## Academic integrity

The old adage, prevention is better than cure, certainly applies here. Although we naturally wish to catch those who try to cheat in their assessments, we much prefer to persuade students not to attempt to cheat by promoting good academic practice and therefore, academic integrity.

In McCabe, Trevino, and Butterfield (2001) the authors provide a list of 10 principles of academic integrity for faculty. They are quoted here for convenience:

1. Affirm the importance of academic integrity
2. Foster a love of learning
3. Treat students as an end in themselves
4. Foster an environment of trust in the classroom
5. Encourage student responsibility for academic integrity
6. Clarify expectations for students
7. Develop fair and relevant forms of assessment
8. Reduce opportunities to engage in academic dishonesty
9. Challenge academic dishonesty when it occurs
10. Help define and support campus-wide academic integrity standards

(McCabe, Trevino, and Butterfield, 2001)

Interestingly, their list from the student perspective includes the provision of deterrents with 'harsh penalties' given as the example: In most institutions the penalties will be determined at institutional, rather than faculty level. Whilst this list was written as a reflection of the previous decade and before the boom in online learning, each of their items resonates in today's higher education environment. A more recent study written firmly in the contemporary technological context does not attempt to modify this list of principles. Van Veen and Sattler (2018) do however, aim to deepen our understanding of the role of deterrence while suggesting other factors fit within the local context. The European Commission funded, Innovation Alliance (<http://www.innovationalliance.eu>), teaches academic integrity as having five interconnected key values. These are: faith (or trust), fairness, respect, honesty, sense of responsibility. These clearly need further elaboration. However, it seems likely these terms could encompass the earlier list of ten.

The rapid increase in online tuition and opportunities for online assessment require no significant rethinking of the majority of the ten principles above, other than extending what we consider to be the classroom and the campus, in principles 4 and 10. Trust, as mentioned in principle 4 does have to be rethought as our view of the classroom is radically changed, from a real space containing a real time interaction between teachers and students. To asynchronous interactions taking place without geographical coincidence and mediated through the internet. Also, student expectations, in principle 6 cannot assume to have remained unchanged and what faculty do and say to clarify these will evolve. Any move into online assessment provides step changes in the opportunities to engage in dishonesty: principle 8 and therefore, also in what is done to reduce these. However, through principle 7, we see

there are new opportunities to develop 'fair and relevant' assessments. In the next section we consider how two different approaches to online assessment address these challenges and opportunities.

## High stakes, low stakes, assessments

There are now well developed online proctoring solutions that enable institutions to manage full examinations with their students dispersed geographically. For some universities this can be the only form of assessment used, e.g.

**Western Governors University in Utah, U.S.A.** This approach supports the traditional examination: an infrequent, high stakes assessment. This is seen as an alternative mode for a traditional form of assessment. So, expectations are set accordingly. The notion of the exam hall is extended to include every space in which a student is being examined. The opportunities to cheat are reduced through a combination of recordings. These may include from multiple cameras, microphones, and screen recorders. The setting of the ratio of students to proctors to satisfy an institution's appetite for risk will also be a factor contributing to the overall trust in the system.

A different, approach is required for the lower stakes, more frequent, assessment that still contributes to a student's overall mark and grade. Both kinds of assessment are supported by the Trust-based authentication and authorship e-authentication analysis, TeSLA, suite of tools. This is a suite of five tools designed to embed within a university's VLE to be invoked, in any combination, as required to authenticate a student's online work. The tools currently include, face recognition, forensic analysis (a student's writing style), keystroke dynamics (the way a student uses a keyboard), plagiarism detection, and voice recognition. However, others can be added in the future. For students and faculty, this is an unfamiliar experience and the expectations of students and staff need to be carefully considered and communicated for the context of each university. For online institutions, the classroom will remain unchanged as this form of assessment is increased. For traditional face-to-face institutions, the idea of classroom may be extended. And for blended institutions, the balance can shift. The use of the tools reduces the opportunity to cheat and those designing assessments will also gradually learn how best to adjust assessments to make the most of the opportunities the tools offer in terms of effectiveness. The tools will also open new opportunities for different forms of assessment that are currently avoided in online assessment. This is essentially a new assessment regime and trust cannot simply be assumed. However, with a transparent approach and the provision of clear explanations and expectations, students may trust this approach.

## The TeSLA project

This European Commission funded three year project that successfully completed at the end of May 2019, brought together eighteen different partner organisations, including seven universities to trial the tools, teaching in seven different languages. The goal was to develop and pilot an online suite of tools that would become a commercially viable solution for institutions to improve trust in online assessment through the e-authentication of students' work. Whilst a technical team continued development of the suite three pilot studies of increasing scope informed this development and tested the tools in a range of situations, from assessment sessions in class at campus-based universities to TeSLA enabled assessments in real distance learning courses at online institutions. Through the following sections we describe the methods used to evaluate the pilot studies and the results they gave.

The seven universities that trialed the TeSLA suite are:

**Distance learning institutions:** the Open University of Catalunya (UOC); Open University, Netherlands (OUNL); Open University, United Kingdom (OUUK)

**Blended learning institutions:** Anadolu University (AU), University of Jyväskylä (JYU).

**Face-to-face universities:** Sofia University (SU); Technical University, Sofia (TUS)

## Method

The three pilot studies were spread so that one was run during each year of the project. Each pilot study had a different purpose and each had a different target number of participants. They were run as follows, with target numbers being met:

**Pilot 1**, Year 1, aims: Test the pilot communication protocol; Test the technical implementation protocol. Target number of student participants: 600. Data was collected through interviews with participants and used to improve the two protocols.

**Pilot 2**, Year 2, aim: Test the TeSLA instruments in an isolated manner in assessment activities. Target number of student participants: 3,500. Partners developed four questionnaires. One pair for student participants and the other for staff participants. Each participant completed one questionnaire before they engaged with TeSLA and the second after they had engaged. These provided pre and post responses and included some free text responses. The data provided feedback for the technical team, the pilot university teams, and for improving the questionnaires for Pilot 3.

**Pilot 3**, Year 3, aim: Test the full integration of the TeSLA system and its scalability. Target number of student participants: Phase 1 – 7,000, Phase 2 – 10,000.

The first two pilots were in effect intermediate development steps to the final Pilot 3.

## Results

The numbers involved in the Pilot studies were as set out in Table 1. This table includes the numbers of participants with special educational needs and disabilities, SEND.

Table 1, The number of student participants, teachers and courses for each of the three Pilots, including the number of SEND students

Pilot	Students	SEND students	teachers	courses
1	637	24	22	24
2	4,931	287	43	125
3	17,373	550	392	310

The chart in Figure 1 shows the spread of participants across subjects in Pilot 2 and both phases of Pilot 3. Whilst in Pilot 3 the majority of participants were studying within engineering and architecture, good numbers of participants were from each of the other subject areas.

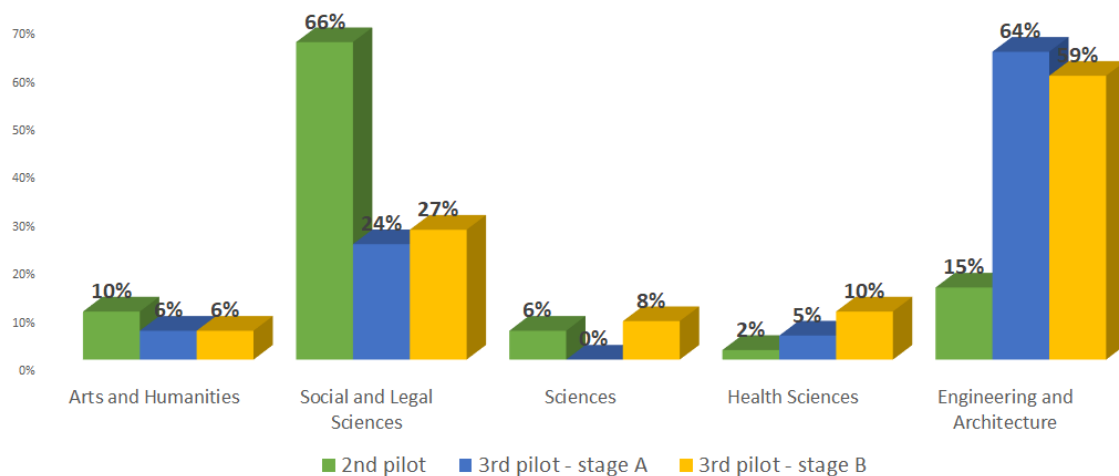


Figure 1, The spread of student participants across subjects, by Pilot. For Pilots 2 and 3

The spread of participants, for Pilot 3, across the seven languages of the project is shown in Figure 2. This shows a fair representation for each language within the results.

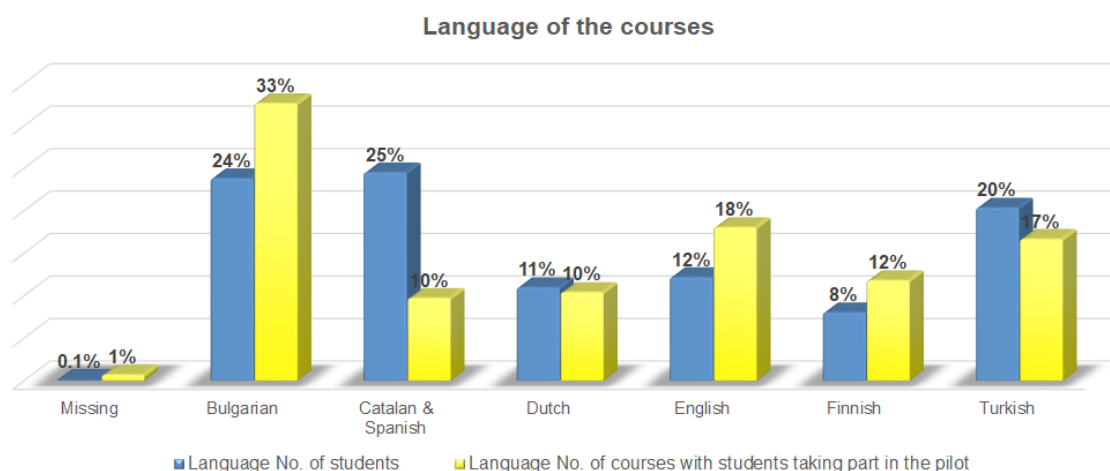


Figure 2, The spread of student participants across the seven languages in Pilot 3.

The gender distribution is revealed in Figure 3, where it shows the percentage of female students by institution for each of the two phases of Pilot 3. Whilst there are variations from institution to institution, there is an overall balance between female and male students.

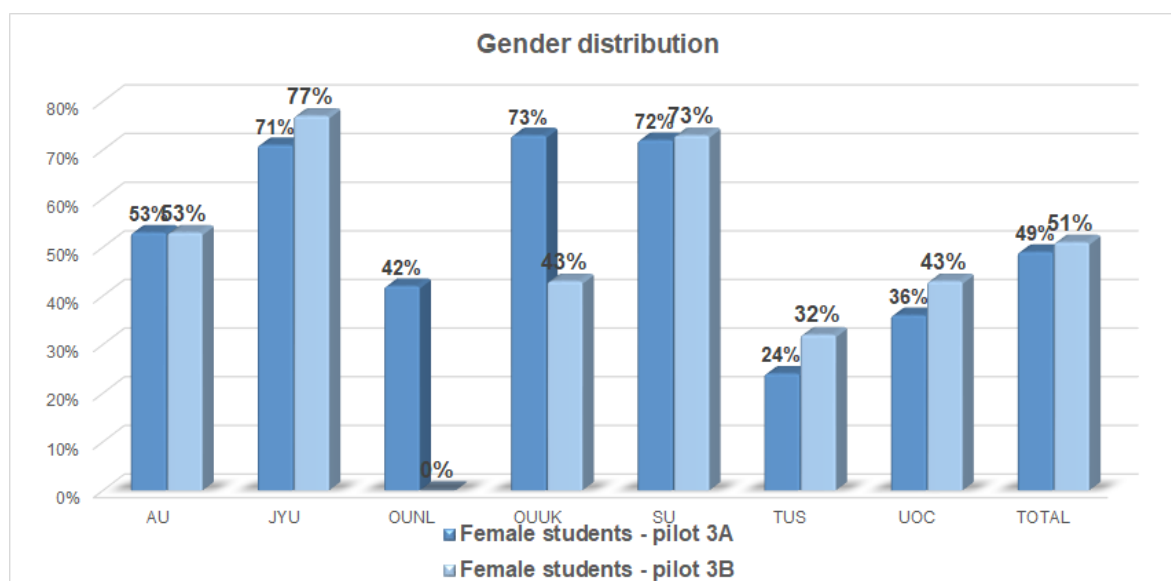


Figure 3, The percentage of female participants for Pilot 3a and 3b by institution

## Assessment details

A range of assessment is included in Pilot 3. There is a spread of formative and summative assessment, with the majority serving both purposes of development and grading. The large majority of assessment was individual, unsupervised, and involved the creation of text artifacts.

Table 2, Summary details for assessment in Pilot 3

Query	Response	% of student-activities
How was the assessment used?	Diagnostic	1%
	Formative	22%
	<b>Formative &amp; summative</b>	<b>58%</b>
	Summative	11%
	N/A	8%
Was the assessment supervised?	Supervised	12%
	<b>Unsupervised</b>	<b>88%</b>
Was the assessment individual or collaborative?	Collaborative	2%
	<b>Individual</b>	<b>94%</b>
	Individual & collaborative	4%
What was the type of response required in the assessment activity?	Select answer	17%
	Create answer or product	<b>73%</b>
	Perform/enact/demonstrate	11%
What was the response format for response type 'Create answer or product'?	Audio	11%
	Video	12%
	<b>Text (natural language or code)</b>	<b>76%</b>
	Artefact (e.g. a painting, a meal, sheet music)	1%

## Special educational needs and disability

A separate study focusing on SEND students was carried out. The numbers of participating SEND students are given in Table 1 above. The data are summarised as:

All SEND students highly appreciated the availability of the TeSLA system which allows for equal opportunities for all students; reducing the pressures on students with severe physical disabilities to drop out from the university; saving time and money for travel; improving productivity; increased flexibility; increasing the reliability in comparison with face-to-face examinations.

Most of the SEND students appreciated the opportunities that TeSLA provides for conducting exams from home on certain occasions, but they did not see online assessment as an alternative to face-to-face assessment because this would limit the opportunities for their socialisation.

The students' experiences and opinions in relation to accessibility and usability of the TeSLA system and its different instruments varied a great deal according to the type and degree of their disability.

The analysis of the data suggests that, due to the heterogeneity of SEND students and the specificity of different disability groups, it is not possible for a system such as TeSLA to satisfy equally the needs of such a diverse group of learners in terms of accessibility and usability.

## Headline findings

The key findings for students are:

1. Using TeSLA was a positive experience for more than 50% of the students
2. Greater than 70% of participating students considered the key advantages of e-assessment with e-authentication to be: 'to ensure that my examination results are trusted' and 'to prove that my essay is my own original work'.
3. The most popular TeSLA instruments for students were Forensic Analysis and Anti-Plagiarism: these instruments were less intrusive. And less effort was required for their use.

4. Many felt e-authentication would increase trust in e-assessment for students, institutions and employees. The most popular reasons given included: e-authentication would make it more difficult for students to cheat.

The key findings for teachers are:

1. Teachers were satisfied or very satisfied with the TeSLA experience (particularly TUS 70% and SU 100%).
2. Most teaching staff agreed that the use of TeSLA 'will increase trust of e-assessment among universities and employers' and 'it will help participants trust the outcomes of e-assessment'.
3. Further improvements (ease of implementation, interoperability, graphical user interface, browsers and OS compatibility) would be welcome.
4. e-authentication made new types of assessments possible for the first time.
5. Almost all the would recommend TeSLA to a colleague and would be willing to adopt it in their institution. Those who wouldn't were only concerned about the technical implementation of the prototype system in their institutions' existing systems

The key findings for SEND students are:

6. Whilst welcome as way of increasing equal opportunity, TeSLA cannot fully support all SEND students
7. SEND students do not want this to be used towards ending all face-to-face opportunities as these offer socialization opportunities.

## Further findings

Ongoing analysis is shedding further light on the data. Okada et al (2018) find that in the OUUK context, whilst there was general acceptance of e-authentication, female students were both more accepting of it and held a greater belief that it had the potential to increase 'the quality and trustworthiness of online assessments'. This is against the background of men being more inclined to share their personal data than women. In the same paper they find that whilst e-authentication may make it easier for some SEND students to participate in online assessment, particularly those with motor disabilities, other SEND students were less positive. They also found there was a difference in attitude related to age. This appeared to centre around the attitude, more commonly held by the young, that the use of e-authentication was a sign the institution does not trust them, rather than as a measure to build trust.

A conference paper presented at ICERI 2018 explored differences in trust between the pre and post participation questionnaires (Edwards et al, 2018). In this paper, the Wilcoxon signed-rank test was used and resulted in the finding that although attitudes to trust were positive in both the pre and post questionnaires, there was a small shift towards students feeling their university did not trust them.

## Discussion

The results from the TeSLA project include a final large-scale study that demonstrates the system can operate at scale and be successfully embedded within a university's virtual learning environment (VLE). It should be noted that the nature of the pilots meant that participants were essentially self-selecting. This is because there was no requirement to participate, and therefore only those that wanted to signed the consent and took part. A further self-selection step took place at the post questionnaire where, as there was no compulsion to complete it, some chose not to. Therefore, the findings cannot be considered completely representative of the student body as a whole.

Despite this caveat, there was broad representation in terms of language, subject, gender and special need or disability. The TeSLA system proved to be an acceptable intrusion for the majority of those who did take part. The SEND study showed that whilst generally welcomed, the TeSLA suite of tools could not fully support all students with special needs and disabilities.

Students were clear that they were more accepting of some of the tools than others. The antiplagiarism and forensic analysis tools were most acceptable whilst the facial and voice recognition tools were less accepted. This was



likely, in part, to do with the effort required to set them up with their initial 'enrolment' data. Another factor is the much more personal nature of the data the tools collected and the fact this was usually not directly related to the work being undertaken: this is writing, as shown in Table 2. Lastly, students are more familiar with this kind of tool being used in surveillance rather than study. Here, we should highlight that in the example of online proctoring, video recording (though not necessarily facial recognition) is fully accepted as necessary. Therefore, with clear guidance and transparency in the use of these tools, expectations can be set that allow them to be used primarily as a deterrent.

## Conclusion

Reflecting on the principles for academic integrity (McCabe, Trevino, and Butterfield (2001), we see that online proctoring has a particular niche for infrequent, high stakes assessment. Where it can operate as a deterrent and allow conventional examinations to be undertaken with an extended examination hall to encompass every student under examination. The TeSLA suite of e-authentication tools, with its ability to be seamlessly embedded within an institution's VLE, can deter cheating and build trust in online assessment, from within the existing 'classroom'. TeSLA can also offer an opportunity; in that it can facilitate new forms of online assessment and allow more relevant forms of assessment to be created.

It can therefore be envisaged, that courses can be designed around the TeSLA technology with the greater variety of relevant assessment that it enables. With clear information, policy and guidance these developments could establish the 'layers of trust' (Edwards et al, 2018) that would make e-authentication generally acceptable. Leading to greater trust in the results of online assessment.

Finally, it is not forgotten that these technologies (like so many others) are not yet sufficiently mature that they can fully support all SEND students. Therefore, alternatives should continue to be developed to ensure all students have a rich and rewarding learning and assessment experience.

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